STAEDTLER® No. 937 811E Engineer's Computation Pad

••30 In Fig. 10-32, wheel A of radius $r_A = 10$ cm is coupled by belt B to wheel C of radius $r_C = 25$ cm. The angular speed of wheel A is increased from rest at a constant rate of 1.6 rad/s^2. Find the time needed for wheel C to reach an angular speed of 100 rev/min, assuming the belt does not slip. (*Hint:* If the belt does not slip, the linear speeds at the two rims must be equal.)

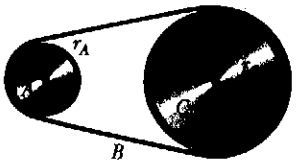


FIG. 10-32 Problem 30.

BELT DOES NOT SLIP
$\Rightarrow$ v = tangential of a Point on the of either wheel
= v of belt = v

$$\Rightarrow \omega_A = \frac{v_{TAN\,A}}{r_A} = \frac{v}{r_A} \quad \& \quad \omega_c = \frac{v_{TAN\,C}}{r_c} = \frac{v}{r_c}$$

$$\Rightarrow \omega_c/\omega_A = v/r_c \,/\, v/r_A = r_A/r_c \quad \checkmark \text{ makes sence}$$

GEARING UP OR DOWN

$$\omega_c = \frac{r_A}{r_c}\omega_A = \frac{r_A}{r_c}\left[\omega_{oA} + \alpha_A t\right] = \frac{r_A \alpha_A}{r_c} t$$

the Units of ω_c are those of $\alpha_A t$
we want ω_c in revolutions/minute

$\Rightarrow$ measure α_A rev/min^2

$$\alpha_A = 1.6 \frac{rad}{s^2}\left(\frac{60s}{min}\right)^2\left(\frac{rev}{2\pi rad}\right) = 917 \frac{rev}{min^2}$$

$$\omega_c = \frac{r_A}{r_c}\alpha_A t \Rightarrow t = \frac{r_c}{r_A}\frac{\omega_c}{\alpha_A}$$

$$t = \left(\frac{25}{10}\right)\frac{100}{917} = 0.273\,min$$

$$= 0.273\,min \times \frac{60s}{min} = 16.4\,s$$

NOTE $\omega_c = \omega_{oc} + \alpha_c t$
$= \frac{r_A}{r_c}\alpha_A t$ We found
$\Rightarrow \alpha_c = \frac{r_A}{r_c}\alpha_A$ & $\omega_{oc} \equiv 0$